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CONSTRUCTION OF EXPERIMENTAL INTEREST MEASURES FOR ENLISTED CLA--ETC(U)

MAY 65 W H HELME , A KATZ

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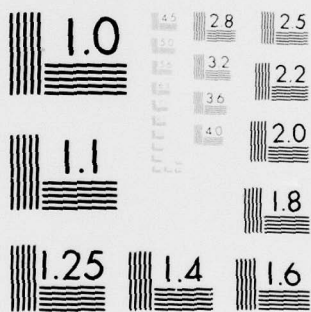
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CONSTRUCTION OF EXPERIMENTAL INTEREST MEASURES
FOR ENLISTED CLASSIFICATION

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CONSTRUCTION OF EXPERIMENTAL INTEREST MEASURES
FOR ENLISTED CLASSIFICATION

Abstract
One of the objectives of the New Classification Techniques Task is to explore new test content which will increase the effectiveness of classification and assignment in the Army. In pursuit of this objective, possible new cognitive information tests have been examined along with new noncognitive tests.

Effort in this direction has included research on occupational interest measures. In the endeavor to meet the need for a measure of mechanical interest, the Army Job Activities Questionnaire (AJAQ-M) has been constructed. The item pool was developed to reflect such factors as expressed interests, experiences, and job preferences that may be predictive of success in training and job performance in construction crafts MOS. The questionnaire was designed to supplement information tests such as the experimental Tool and Trade Knowledge Tests.

The present publication describes the selection of cluster keys based on an internal analysis of the interrelationships among items and sections of the AJAQ-M. It was hoped that these keys would provide greater understanding of the dimensions of personality expressed through preferences for job activities of various kinds and/or job requirements associated with construction crafts MOS.

PROCEDURES

SAMPLE

A sample of 612 enlisted men in reception processing at Fort Leonard Wood and Fort Dix was administered the questionnaire in the fall of 1961.

ARMY JOB ACTIVITIES QUESTIONNAIRE, AJAQ-M (PT 4090)

Activities-Interest Scale, Section I. This section consists of 100 four-choice items, each of which describes an activity specific to a related set of jobs in construction crafts MOS. For each of the 100 items, the examinee was required to indicate one of the following:

- A) It is the kind of activity I like in a job.
- B) It is O.K. as part of the job.
- C) I don't like this kind of activity, but am willing to do it on a job.
- D) I wouldn't take a job with this kind of activity in it.

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Item responses were treated as dichotomies, the split being made at the alternative which gave a "p" value closest to .50.

Job Requirements, Section II. This section consists of 50 two-choice items, each of which contains alternative requirements applicable across enlisted MOS jobs generally. For each item, the examinee was required to indicate whether he preferred requirement A or requirement B.

Job Interest Checklist, Section III. (Occupational Preferences). For each of 11 jobs (Carpenter, Rough; Carpenter, Finish; Mason; Heavy Construction Specialist; Heavy Construction Machine Operator; Plumber; Refrigeration Specialist; House Electrician; Lineman; Heating and Ventilating Specialist; Water Supply Specialist), a brief description of the duties and the equipment used is given. The examinee was to indicate whether or not the assignment would be acceptable to him, assuming he would be given the necessary training.

Section IV (Pre-Service Mechanical Experience). For each of 18 mechanical activities, the examinee marks Yes or No as to whether he has ever performed the activity. Each of these activities pertains to one of the particular jobs in the checklist of Section III.

METHOD OF ANALYSIS

Phi coefficients were computed among the 100 items in Section I, Activities-Interest Scale, and the 50 items in Section II, Job Requirements. In addition, phi coefficients were computed between the items in the Activities-Interest Scale, the Job Requirements Section, Expressed Job Preferences (Section III), and the pre-service experiences (Section IV).

As a means of identifying sets of items which would measure psychological characteristics, the intercorrelation matrices for the Activities-Interest Scale and for Job Requirements were examined separately and pairs of items having the highest phi coefficients were selected as key pairs. Items which correlated at least .25 with both members of a pair of key items were identified. These items, together with the key pair of items, formed the nucleus of a particular cluster. The content of the items in a cluster determined the designation given to that cluster. Other items in the section were then examined to identify those which on the basis of similar content might be included in a cluster. An intercorrelation matrix of all the items in each cluster was then prepared. In order to ascertain the extent to which a single common factor could account for the intercorrelation of items within a cluster, the Wherry "clean-up" method was applied, that is, successive estimates of the factor loadings were made for the items in a cluster for purposes of minimizing the magnitude of the residuals remaining after a single factor was extracted.

Corroborative support for the clusters established as a result of the procedures outlined above was sought from the examination of the correlation coefficients of the items in the Activities-Interest Scale and

Job Requirements Section with Expressed Job Preferences. This examination determined which of the preferred activities and/or job requirements were most closely associated with any of the expressed job preferences. Judgments were made as to whether there was logic to the relationships found. Another step was to ascertain whether the items from the Activities-Interest Scale and Job Requirements Section which were most closely related to each of the expressed job preferences were parts of the same item cluster.

RESULTS

IDENTIFICATION OF CLUSTERS

The clusters formed by building up from highly intercorrelated key items in each section of the AJAQ-M are identified below by name and number of items:

<u>Cluster</u>	<u>No. Items</u>
<u>Section I</u>	
Power	39
Danger	18
High-level Technical	14
Discomfort	9
<u>Section II</u>	
Mechanical Blue-Collar vs Technical White-Collar	17

"Power" is described as the exertion of physical force on material, either directly or through use of equipment.

The "Danger" cluster includes job activities or the use of materials which involve appreciable risk to life or limb.

The "High-level Technical" cluster consists of job activities which require the achievement of high-level technical knowledge and/or skills.

The "Discomfort" cluster consists of distasteful job activities, activities which take place under unpleasant working conditions, or pain-taking or monotonous activity of prolonged duration.

The "Mechanical Blue-Collar vs Technical White-Collar" cluster refers to a preference for jobs requiring physical activity, working on practical problems, or using heavy machinery and wearing work clothes over jobs requiring mental activity, working on theoretical problems, using arithmetic, wearing a white shirt, and the like.

All clusters are listed in the Appendix. After extraction of the first factor loadings from the intercorrelation matrix of a given cluster, residual matrices were computed. The distribution of residuals for each cluster is presented in Table 1.

The bulk of the residuals shown in the table are of low magnitude--80 percent fall between $-.10$ and $+.09$ and 94 percent between $-.15$ and $+.14$. It would seem that a single factor would to a large extent account for the intercorrelation of items within any one cluster. The number of residuals in the $.10$ to $.20$ range, however, suggested the presence of some other group factors of minor magnitude. Most of these intermediate residuals were found in the large "Power" cluster.

Table 1
DISTRIBUTION OF RESIDUALS IN EACH CLUSTER

Range of Residuals	Clusters				
	Power	Danger	High-Level Technical	Discomfort	Mechanical Blue-Collar vs Technical White Collar
.35 to .39	1	0	0	0	0
.30 to .34	0	0	1	0	0
.25 to .29	4	3	0	0	0
.20 to .24	3	1	0	0	1
.15 to .19	20	6	0	0	6
.10 to .14	45	9	4	2	14
.05 to .09	95	29	6	4	29
.00 to .04	166	32	17	13	27
-.05 to -.01	181	40	26	15	23
-.10 to -.06	142	23	24	2	28
-.15 to -.11	69	9	10	0	8
-.20 to -.16	15	1	3	0	0
Total number of Residuals	741	153	91	36	136

Accordingly, the factoring of the Power cluster was continued. Four group factors were extracted by the Wherry "clean-up" method, and some adjustments were made in the loadings on the general factor which had been extracted first. The residual matrix, after extraction of all five factors, showed only one loading above $.20$, only 4 loadings in the $\pm .15$ to $.20$ range, and a total of only 30 loadings beyond $\pm .10$ (as compared to nearly 150 loadings of that magnitude after extraction of the first factor).

Inspection of items loading on each of the four group factors revealed the following content: (1) heavy construction work (8 items), (2) installation and repair (10 items), (3) operating heavy construction machines (6 items), and (4) use of carpenter tools (4 items). These item sets are presented in Table A-1 of the Appendix.

Cluster analysis was applied also to Sections III (Job Preferences) and IV (Pre-service experience). The results, shown in Tables A-6 and A-7, indicated three identifiable clusters in each section. Moreover, the clusters appeared quite similar, as shown below:

<u>Cluster</u>	<u>Job Preferences</u>	<u>Mechanical Experience</u>
1. Manual Construction Skills	Carpenter, rough	carpentry (4 items)
	Mason	masonry (1 item)
2. Heavy Construction	Heavy Construction Spec	building construction (3 items)
	Construction Machine Op	construction machine operation (1 item)
	Lineman	
3. Installation & Maintenance	Heating & Ventilating Spec	plumbing (2 items)
	Plumber	telephone installation (1 item)
	Refrigeration Spec	heating-ventilating (1 item)
	Electrician	

Except for the ambiguous position of Lineman, related to both the heavy construction activities and electrical installation, the factor structures of the two sections are parallel.

RELATION OF SPECIFIC PREFERENCES AND EXPERIENCE TO JOB PREFERENCES

Specific Activity Preferences (Section I). The next step was to analyze the relation of specific preferences and experience to the expressed job preferences in Section III. First, the relation of the 100 specific activity preferences was examined.

These relations were examined in the following way: First, the relation of individual items in Section I to individual job preferences in Section II was noted. This took the form of compiling a list of specific activity preferences correlating .20 or higher with each job preference. For all but 2 of the 11 job preferences, there were 27 to 35 such items for each job preference. Only Carpenter, finish (3 items) and Water Supply Specialist (5 items) failed to yield such a list.

Second, the lists were broken down according to the number of items in each cluster category, including the secondary factor groups within the Power cluster. Table 2 presents the breakdown. It is clear that the two Heavy Construction jobs show high correlations with most of the Danger items and Power items other than the Installation-Repair sub-cluster, while the four Installation and Repair jobs correlated with most Installation-Repair items of the Power cluster, and (except for Plumber) with most items of the Technical cluster.

Finally, both jobs and activity preferences were grouped in clusters (lower section of Table 2). The results show the Manual Skills correlating with most of the activity items except Technical, the Heavy Construction jobs correlating with the Danger items and with the Power items except Installation-Repair, and the Installation and Repair jobs correlating mainly with Installation-Repair items and Technical items.

To summarize, it appears that the specific activity preferences relate to expressed job preferences in terms of a few broad factors and some minor specifics. The relationships noted are roughly depicted in Figure 1.

Job Conditions (Section II). Analysis of the correlation of preferred job conditions to specific job preferences yielded a moderately well-defined single cluster structure. Correlation coefficients of job conditions with job preferences were generally lower than those of specific activities. Of the 50 items, only 22 showed one or more coefficients of .20 with job preferences. These were largely confined to four jobs: Carpenter, rough (10), Heavy Construction Specialist (17), Construction Machine Operator (19), and Water Supply Specialist (13). From this result, it is clear that the overlap of items was extensive: the 19 items correlated with Construction Machine Operator comprised all the Carpenter and Water Supply items and all but 3 of the Heavy Construction Specialist items. The item correlations with Water Supply Specialist were in the opposite direction from the other correlations, however.

When the Blue Collar-White Collar cluster was compared with the sets of 22 items noted above, every one of the 17 items in the cluster was found among the 22. Thus, it is clear that a single factor subsumes virtually all the relationships found between preferred job conditions and expressed job preferences.

Table 2

RELATION OF SPECIFIC ACTIVITY PREFERENCES (SECTION I)
TO EXPRESSED JOB PREFERENCES (SECTION III)

Job Preference Scale	Total Items r=.20+	Power Cluster					Other	Clusters ^a	
		(11) Gen	(8) MC	(6) CM	(10) IR	(4) CT	(18) Danger	(14) Tech	(29) Other
Carpenter	32	6	8	6	3	4	1	0	4
Mason	32	7	7	4	7	4	1	0	5
Heavy Const Spec	29	5	2	6	1	0	11	0	4
Const Machine Op	33	9	4	6	1	3	6	0	4
Lineman	24	3	0	2	6	0	11	0	2
Plumber	28	5	4	1	8	3	0	1	6
Refrigeration Spec	29	19	0	0	9	1	0	10	5
Electrician	27	4	0	0	10	1	4	6	2
Heat & Ventil Spec	29	7	2	1	9	1	0	4	5
Water Supply Spec	5	0	0	0	0	1	0	3	1

Job Cluster	Total Items r=.15+	Power Cluster					Other	Clusters ^a	
		Gen	MC	CM	IR	CT	Danger	Tech	Other
Manual Skills	51	10	8	6	8	4	4	0	11
Heavy Construction	46	8	5	6	2	3	15	0	7
Installation & Maint	44	7	3	1	10	3	4	9	7

^a"Discomfort" cluster was grouped with "other" because only 1 out of the 9 items showed any correlations of .20 or higher.

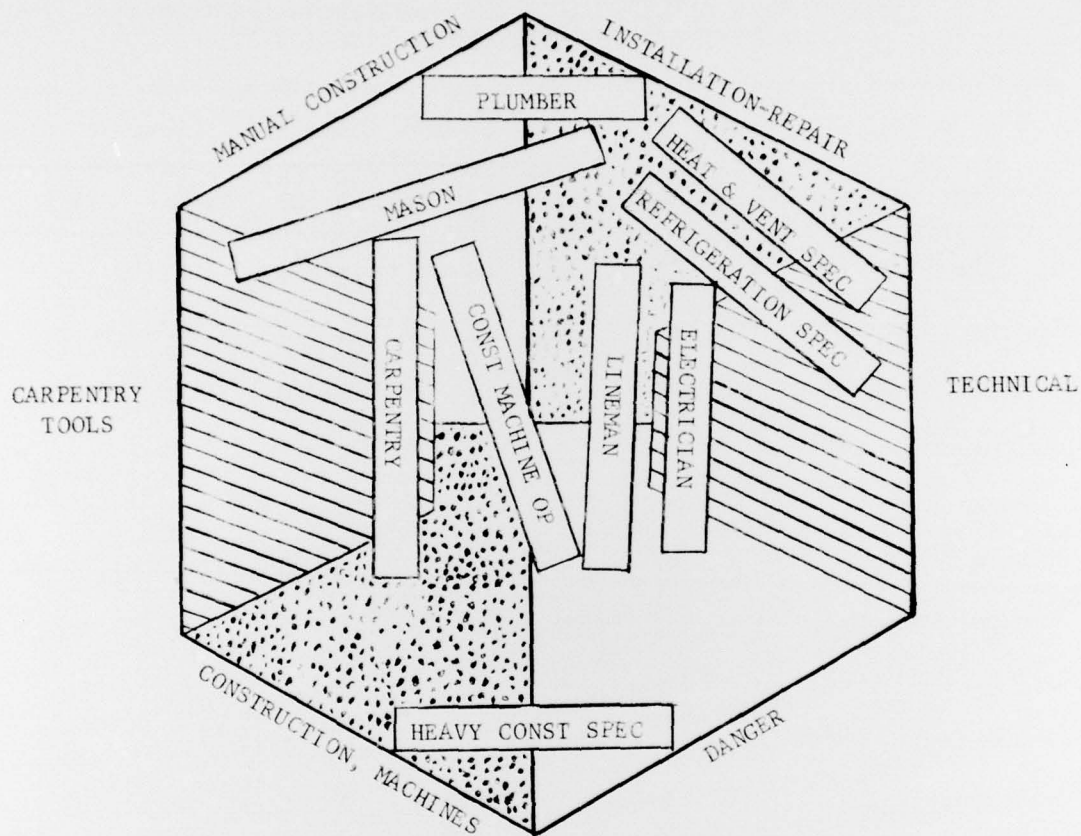


Figure 1. Schema Representing Relations Between Specific Activity Preferences and Expressed Job Preferences

Mechanical Experience (Section IV). Of the 18 items in Section IV, 15 showed at least one correlation coefficient of .20 or higher with job preferences. The Manual Skills and Heavy Construction jobs showed the highest number of correlated items: Heavy Construction Specialist (8), Construction Machine Operator (6), Carpenter (4), and Mason (3). When the job preferences were grouped and the mechanical experience clusters applied, a clear set of relationships emerged:

<u>Job Preferences</u>	<u>Average Item Correlation of .15+ Mechanical Experience</u>			
	<u>Total</u>	<u>Manual Skills (5)</u>	<u>Heavy Const (4)</u>	<u>Installation-Maint (4)</u>
Carpenter-Mason	7	5	0	2
Hvy Const-Const Mach Op	9 ^a	3	4	1
Plumber-Refr Sp-Heat & Vent Sp	4 ^a	0	0	3
Electrician-Lineman	4	1	0	3

^a One item not in a major cluster but with small loadings on the Manual Skills and Installation-Maintenance clusters was found correlated with these jobs.

When average correlations of all items in each cluster with job preference groups were examined, a more precise picture was revealed:

<u>Job Preferences</u>	<u>Manual Skills</u>	<u>Mechanical Experience</u>		
		<u>Hvy Const</u>	<u>Instl-Maint</u>	<u>Other</u>
Carpenter-Mason	.25	.07	.10	.02
Hvy Const-Const Mach Op	.17	.24	.13	.04
Plumber-Refr Sp-Heat & Vent Sp	.09	.00	.16	.07
Electrician-Lineman	.10	.05	.19	.08

SUMMARY AND CONCLUSIONS

Based on a sample of 612 enlisted men on entry into Service, the inter-correlations of a set of 179 items of the Army Job Activities Questionnaire-Mechanical (AJAQ-M) were analyzed to yield understanding of the structure of expressed mechanical interests. The questionnaire included four types of items measuring degree of preference for particular mechanical job activities (Section I), preference choice between pairs of job conditions (Section II),

degree of preference for assignment to described jobs (Section III), and pre-service experience in mechanical activities (Section IV). The matrix of correlations within each section yielded a few broad clusters comprising most items in the section. Then the items and clusters from each section were correlated with the expressed job preferences of Section III to indicate what factors appeared to underlie such expressed job preferences.

The results suggested that preferences for the jobs and activities studied, which were in the construction and related electrical and utilities areas, could be broadly grouped into categories of manual construction skills, heavy construction (including rigging and construction machine operation), installation and maintenance of utility equipment, and possibly electrical construction. The relations among items of a given type or section and the relation between such items and expressed job preferences were largely accounted for by these underlying categories. It may be concluded that, within the area studied, effective direct measurement of expressed job interests may be made by sampling of such categories. A later report will cover the predictive value of such measured interests for actual performance in training for Army Military Occupational Specialties in the mechanical domain.

APPENDIX

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Table A-1

LOADINGS OF ITEMS ON FACTORS IN POWER CLUSTER

Item	General I	Manual Const II	Instl & Repair III	Const Equip Op IV	Carp Tools V
17AB	50				
19AB	60				
46AB	55				
57AB	50				
67AB	60				
68AB	50				
79AB	65				
84AB	55				
91AV	65				
94AB	50				
96AB	50				
32AB	50	25			
34AB	50	30			
38AB	60	50			
41AB	60	40			
44AB	50	30			
54AB	60	40			
56AB	60	20			
71AB	60	20			
21AB	55		20		
23AB	45		30		
48AB	45		40		
72AB	60		30		
74AB	55		40		
75AB	50		30		
77AB	55		30		
80AB	55		30		
81AB	60		30		
85AB	55		40		
59AB	55			45	
61AB	55			60	
64A	45			45	
69AB	60			60	
70AB	60			25	
98AB	60			35	
82AB	60				40
89AB	65				40
93AB	60				30
99AB	65				30

Table A-2

LOADINGS OF ITEMS ON FACTOR IN DANGER CLUSTER

Section I

6ABC	- 60
8ABC	- 60
12ABC	- 50
16ABC	- 60
24ABC	- 60
28AB	- 50
30ABC	- 60
31ABC	- 50
33ABC	- 60
35ABC	- 50
43AB	- 50
49AB	- 50
51AB	- 60
52ABC	- 50
53AB	- 50
58AB	- 50
60AB	- 40
76AB	- 40

Table A-3

LOADINGS OF ITEMS ON FACTOR IN HIGH-LEVEL TECHNICAL CLUSTER

Section I

7AB	- 50
10AB	- 50
11AB	- 50
13AB	- 70
15AB	- 70
63AB	- 70
66AB	- 50
78AB	- 50
87A	- 60
88AB	- 50
90A	- 50
95AB	- 60
97AB	- 70
100AB	- 60

Table A-4

LOADINGS OF ITEMS ON FACTOR IN DISCOMFORT CLUSTER

Section I

26ABC	- 55
27ABC	- 65
37ABC	- 65
40ABC	- 55
45ABC	- 65
47ABC	- 60
55ABC	- 60
62ABC	- 55
83ABC	- 65

Table A-5

LOADINGS OF ITEMS ON FACTOR IN MECHANICAL BLUE-COLLAR
VS. TECHNICAL WHITE-COLLAR CLUSTER

Section II

5A	- 50
7A	- 60
10B	- 50
11B	- 65
13A	- 50
14B	- 70
15B	- 70
18B	- 65
19A	- 70
20B	- 70
24B	- 30
26A	- 40
27A	- 40
35B	- 70
36B	- 60
40A	- 50
48A	- 60

Table A-6

LOADINGS OF ITEMS ON FACTORS IN EXPRESSED JOB PREFERENCES

Item	Occupation	Factor Loadings		
		I Manual Skills	II Heavy Const	III Installation & Maintenance
51	Carpenter, rough	<u>50</u> ^a		20
52	Carpenter, finish	30		25
53	Mason	<u>70</u>		30
54	Heavy Construction Spec	20	<u>50</u>	
55	Construction Machine Op	30	<u>50</u>	20
56	Plumber	30		<u>60</u>
57	Refrigeration Specialist			<u>60</u>
58	Electrician			<u>55</u>
59	Lineman		<u>40</u>	25
60	Heating & Ventilating Spec			<u>75</u>
61	Water Supply Specialist			20

^a Underlined values were loadings on which selection of items was based.

Table A-7

LOADINGS OF ITEMS ON FACTORS IN PRE-SERVICE EXPERIENCE

Item	Type of Experience	p	Factor Loadings			IV Residual
			I Manual Skills	II Heavy Const	III Installation & Maint	
62	Rough carpentry	.41	<u>70</u> ^a			
63	Carpentry	.36	<u>70</u>			
64	Carpentry	.33	<u>70</u>			
65	Finish carpentry	.15	<u>50</u>			
66	Masonry	.41	<u>60</u>			
67	Rigging	.07	20	<u>50</u>		
68	Steelwork	.17	30	<u>60</u>		
69	Rigging	.18	30	<u>70</u>		
70	Construction machine operation	.17	30	<u>40</u>		
71	Plumbing	.51	40	20	<u>60</u>	
72	Plumbing	.30	40		<u>60</u>	
73	Refrigeration, air conditioning	.05	20		20	30
74	Electrical installation	.04	20	20		30
75	Telephone installation, linework	.48	40		<u>40</u>	
76	Heating, ventilating	.11	20	20	<u>40</u>	40
77	Sheet metal work	.05	00			20
78	Water purification, testing	.30	30	20	30	
79	Filtration equipment operation	.02	00			40

^aUnderlined values were loadings on which selection of items was based.